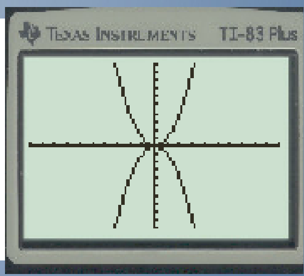
Vertex Form...

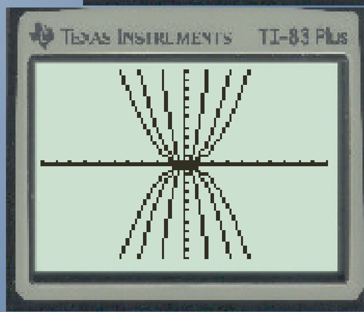
$$y = a(x - h)^2 + k$$

Direction of Opening: ("Look at the sign of the stretch factor")



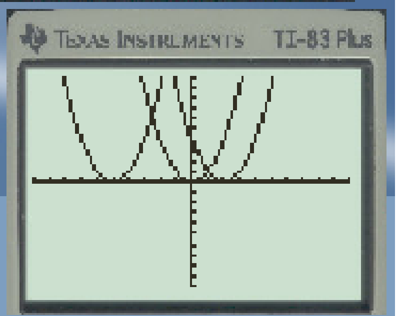
- If $a > 0$, then the graph *opens upward*.
- If $a < 0$, then the graph opens *downward*.

Vertical Stretch: ("Look at the magnitude of the stretch factor")



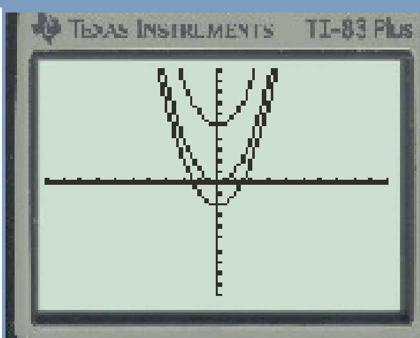
- If $|a| > 1$, then the graph becomes *narrower*.
- If $|a| = 1$, then the graph *stays the same*.
- If $0 < |a| < 1$, then the graph becomes *wider*.

Horizontal Translation: ("Think opposite")



- If $h > 0$, then the graph *moves to the right h units*.
- If $h = 0$, then the graph *does not move horizontally*.
- If $h < 0$, then the graph *moves to the left h units*.

Vertical Translation: ("Exactly the same")



- If $k > 0$, then the graph *moves upward k units*.
- If $k = 0$, then the graph *does not move vertically*.
- If $k < 0$, then the graph *moves downward k units*.

ALL Properties of a Quadratic

$$\boxed{y = a(x - h)^2 + k}$$

- **TRANSFORMATIONS...** stretch factor is positive
- stretch factor 'a' --> direction of opening & shape
- translations 'h' and 'k' --> horizontal / vertical movements

- **KEY POINTS...**
- vertex (h, k) --> lowest / highest point on the parabola
- x intercept(s) --> where the graph crosses the x axis
  --> let y = 0 and solve for x
  (we will come back to this property)
- y intercept --> where the graph crosses the y axis
  --> let x = 0 and solve for y
  --> is the 'c' value in standard form

- **PROPERTIES...**
- Domain --> describes all possible x values
  --> for quadratic functions {x ϵ R}
- Range --> describes all possible y values
  --> depends on direction of opening and "k" value in vertex
- Maximum / Minimum Value --> highest / lowest y value
  --> depends on direction of opening and "k value)
- Axis of symmetry --> vertical line of symmetry through vertex
  [A.O.S] --> described through x = h

Ex: Vertex Form $y = -3(x+2)^2 - 5$

$a = -3$ (open down, stretch factor is 3 -> narrow)

$h = -2$ (Left 2)

$k = -5$ (Down 5)

-> vertex $(-2, -5)$

y int (let $x = 0$)

$y = -3(0+2)^2 - 5$

$y = -3(4) - 5$

$y = -12 - 5$

$y \overset{int}{=} -17$ $(0, -17)$

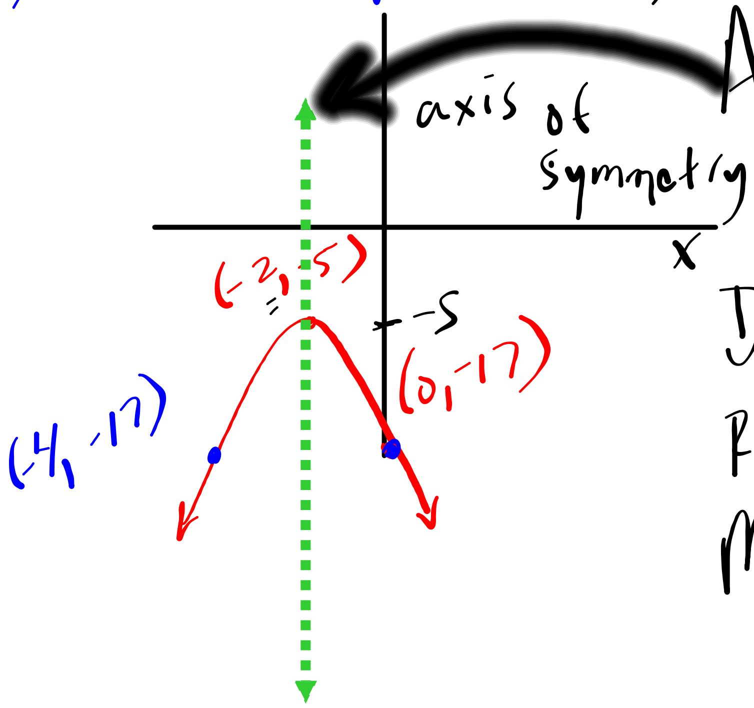
Sketch

Need 3 points...

1) vertex $(-2, -5)$

2) y int $(0, -17)$

* 3) Reflection point



A.O.S

$x = -2$

Domain -> $\{x \in R\}$

Range -> $\{y \leq -5\}$

Max: y-value of -5

Vertex Form $y = -3(x+2)^2 - 5$

expand

$y = -3(x^2 + 4x + 4) - 5$

$y = -3x^2 - 12x - 12 - 5$

Standard Form $y = -3x^2 - 12x - 17$

a

y-int

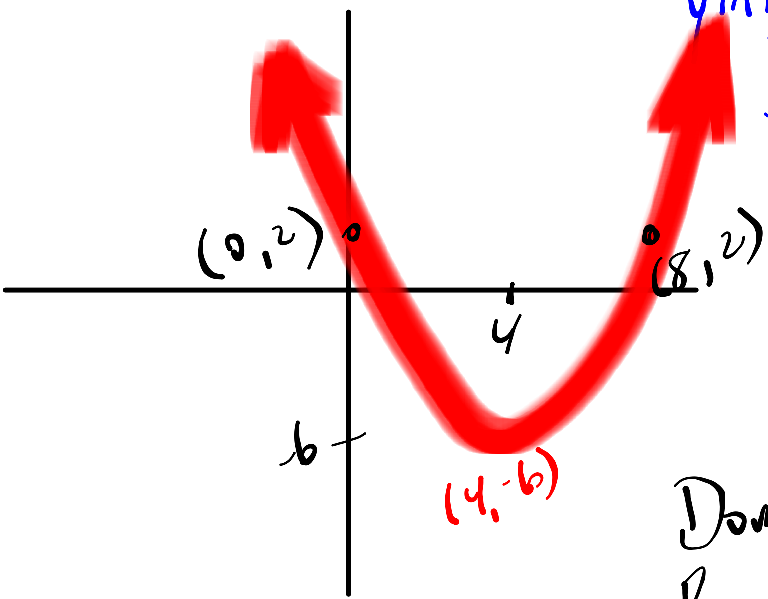
Ex #2: $y = \frac{1}{2}(x-4)^2 - 6$

$a = \frac{1}{2}$ ← open up, wider, s.f. $= \frac{1}{2}$

$h = 4$ ← right 4

$k = -6$ ← down 6

vertex $(4,-6)$



y int

$y = \frac{1}{2}(0-4)^2 - 6$

$y = \frac{1}{2}(16) - 6$

$y = 8 - 6$

$y = 2$ $(0,2)$

Domain → $\{x \in \mathbb{R}\}$

Range → $\{y \geq -6\}$

A.O.S → $x = 4$

Min y value of -6

V

$$y = \frac{1}{2}(x-4)^2 - 6$$

expand

$$y = \frac{1}{2}(x^2 - 8x + 16) - 6$$

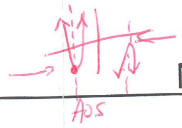
$$y = \frac{1}{2}x^2 - 4x + 8 - 6$$

$$y = \frac{1}{2}x^2 - 4x + 2$$

S

HOMEWORK... FINISH

Worksheet - Properties of Quadratics.docx

Min  Max

Quadratic Functions

Name: Answer Key

* Algebra let $x=0$

1. The following equations are in Standard Form. Please complete the chart.

Function Remember: **$y = a(x-h)^2 + k$**	a	h think opposite	k	Vertex (h,k)	Axis of symmetry X=h	Range - opens ? - K value	Standard form $y = ax^2+bx+c$	y-intercept	Max/Min y-value (K)
$y = \frac{3}{4}(x-2)^2 + 6$	3/4 ↑	2	6	(2,6)	$X=2$	$y \geq 6$	$y = \frac{3}{4}x^2 - 3x + 9$	(0,9)	Min 6
$y = -(x-5)^2 - 3$	-1 ∩	5	-3	(5,-3)	$X=5$	$y \leq -3$	$y = -x^2 + 10x - 28$	(0,-28)	Max -3
$y = 9(x-\frac{1}{2})^2 + 10$	9 ∪	1/2	10	(1/2, 10)	$X = 1/2$	$y \geq 10$	$y = 9x^2 - 9x + 12.25$	(0, 12.25)	Min 10
$y = -2(x+3)^2 + 4$	-2 ∩	-3	4	(-3,4)	$X=-3$	$y \leq 4$	$y = -2x^2 - 12x - 14$	(0,-14)	Max 4
$y = 5(x-1)^2$	5 ∪	1	0	(1,0)	$X=1$	$y \geq 0$	$y = 5x^2 - 10x + 5$	(0,5)	Min 0
$y = 4x^2 + 6$	4 ∪	0	6	(0,6)	$X=0$	$y \geq 6$	$y = 4x^2 + 6$	(0,6)	Min 6
$y = (x-3)^2 - 17$	1 ∪	3	-17	(3,-17)	$X=3$	$y \geq -17$	$y = x^2 - 6x - 8$	(0,-8)	Min -17
$y = x^2 - 5$	1 ∪	0	-5	(0,-5)	$X=0$	$y \geq -5$	$y = x^2 - 5$	(0,-5)	Min -5
$y = \frac{3}{4}(x+2)^2 + 1$	3/4 ∪	-2	1	(-2,1)	$X=-2$	$y \geq 1$	$y = \frac{3}{4}x^2 + 3x + 4$	(0,4)	Min 1
$y = -4.9(x-1.5)^2 + 40.2$	-4.9 ∩	1.5	40.2	(1.5, 40.2)	$X=1.5$	$y \leq 40.2$	$y = -4.9x^2 + 14.7x + 29.175$	(0, 29.175)	Max 40.2
$y = x^2$	1 ∪	0	0	(0,0)	$X=0$	$y \geq 0$	$y = x^2$	(0,0)	Min 0
$y = (x-2)^2$	1 ∪	2	0	(2,0)	$X=2$	$y \geq 0$	$y = x^2 - 4x + 4$	(0,4)	Min 0
$y = -3(x+5)^2 - 4$	-3 ∩	-5	-4	(-5,-4)	$X=-5$	$y \leq -4$	$y = -3x^2 - 30x - 79$	(0,-79)	Max -4
$y = \frac{1}{2}(x-8)^2 + 7$	1/2 ∪	8	7	(8,7)	$X=8$	$y \geq 7$	$y = \frac{1}{2}x^2 - 8x + 39$	(0,39)	Min 7

a) $y = \frac{3}{4}(x-2)^2 + 6$

Attachments

Worksheet - Properties of Quadratics.docx